

**REMARKS**

Reconsideration of this application is requested. Claims 1-15 are in the case.

**I. THE 35 USC 112, SECOND PARAGRAPH, REJECTION**

Claim 1 stands rejected under 35 USC 112, second paragraph, as allegedly indefinite in light of the term "substantially". That rejection is respectfully traversed.

The expression "substantially free of metallic or metal compound": is defined in the specification at page 2, lines 9-14. Thus, it is stated:

"By the expression 'substantially free of metallic or metal compound impurities' is meant here and throughout the specification that the total feed to the reactor has no more than 0.1 ppm of metals and/or metal compounds,..... prior to being brought into contact with the catalyst...."

Given this definition, it is believed that no indefiniteness arises with respect to Claim 1. However, in order to advance prosecution, Claim 1 has been amended without prejudice to incorporate this definition. No new matter is entered and no new issues are raised. Withdrawal of the formal rejection is accordingly respectfully requested.

## II. THE OBVIOUSNESS REJECTION

Claims 1-15 stand rejected under 35 USC 103(a) as allegedly unpatentable over Atkins et al (EP 0757027) in view of Nishino et al and Sato (U.S. 4,465,852). That rejection is respectfully traversed.

The process of the present invention is for the production of lower aliphatic esters (e.g. ethyl acetate). The process comprises reacting a lower olefin (e.g. ethylene) with a saturated lower aliphatic mono-carboxylic acid (e.g. acetic acid) in the vapor phase in the presence of a heteropolyacid catalyst. The reaction is carried out in a plurality of reactors set up in series, and the feedstock is rendered substantially free of metallic or metal compound impurities prior to being brought into contact with the heteropolyacid catalyst.

The main feature of the invention is that removal of metallic impurities from the feedstock provides a surprising improvement in the catalyst life and in ester productivity. Such impurities can arise from a variety of sources in commercial feedstocks, e.g., from the presence of metal cations in water supplied from local sources, from corrosion of steel pipe-work and reactor vessels around which components of the feedstock materials are frequently recycled, and from impurities which are frequently present in commercial grade starting materials.

The prior art cited by the Examiner clearly would not lead one of ordinary skill in the art to take any special precautions in relation to the removal of free metal or metal cations in the feedstock to the acid/olefin reaction. While it may

be true that one skilled in the art might try employing starting materials that are reasonably pure, it does not make economic sense for the skilled person to go out of his or her way to use specially purified materials unless there are good reasons to do so. For example, it would be natural for one skilled in the art to use local water (which invariably contains metal ions) for an industrial process, unless specifically instructed to use de-ionised water.

Claim 1 requires that the feedstock be rendered substantially free of metallic impurities prior to contact with the catalyst. Atkins discloses that the catalyst support preferably has less than 0.3% (3000 ppm) by weight of impurities, but Atkins is completely silent as regards the feedstock purity. Claim 1 is clearly patentably distinguished from Atkins et al on this basis alone.

Atkins relates to the same technology as the presently claimed process and therefore represents a good basis for one skilled in the art to consult if wishing to improve a process. Atkins discloses that it is desirable to employ a silica support (for the heteropolyacid catalyst) that is "suitably free from extraneous metals or elements which might adversely affect the catalytic activity of the system". Atkins does not, however, cast any light on what is meant by "extraneous metals or elements". Indeed, in a similar manner to the present specification, Atkins mentions metals that can be present as "counter-ions" (i.e., cations) in the heteropolyacid catalysts (see Atkins Table at the foot of Page 2 bridging page 3, and associated text), wherein are mentioned sodium, potassium, and cesium salts of the heteropolyacids.

Thus, Atkins discloses to the skilled person that the Atkins catalyst should be desirably supported on a silica support prepared using a silica that is free from "extraneous metals or elements". However, there is no suggestion anywhere that the feedstock to the reaction need be especially freed from any impurities and nothing in Atkins would lead the skilled person to conclude that freeing the feedstock from metals would result in special advantages. Accordingly, Atkins falls far short of leading toward the present invention.

Sato fails to give rise to a *prima facie* case of obviousness when combined with Atkins. The introductory paragraph of Sato describes two prior art methods of making esters by reaction of olefins with carboxylic acids. The first type ({1}-relating to the use of strong acids such as sulphuric) is described as having the serious defect of causing corrosion of the apparatus. The second type ({2} - which relates to the use of heteropolyacid catalysts) is said to have the disadvantage of producing (by-product) alcohols and, also, of giving the wrong product when ethylene is employed as the olefin. Thus, if Sato says anything in relation to the technology of the present invention, it is saying, "Don't use it!"

Sato goes on to say that in order to remove the above disadvantages, "a method using various ion exchange resins has been proposed". It is believed that it is far from clear what this means at all. There is no disclosure as to what is meant by this "ion exchange" technology, or as to the purpose of employing ion exchange resins. The reader is left questioning whether these resin catalysts

incorporate acid catalysts or whatever? Moreover, there is no disclosure as to whether the use of these "various ion exchange resins" ever met with any success.

Sato then goes on to describe a different type of catalyst based on a crystalline metallosilicate type of catalyst (which is entirely different from the heteropolyacid catalyst of the present invention). Sato is clearly irrelevant to the invention as presently claimed.

The question is: whether it would have been obvious to one of ordinary skill, in the light of the cited prior art, to remove impurities from the feedstock prior to contact with the catalyst, in order to improve the performance of the catalyst. Atkins makes no mention of the purity of the feedstock, still less that it contains impurities which could adversely affect catalytic performance. Consequently, the person of ordinary skill reading Atkins is given no suggestion that removal of impurities from the feedstock would be a good thing to do. As for Sato, it is simply irrelevant. Sato adds nothing to the disclosure of Atkins: all that Sato suggests is that strong acid catalysts (not used in the present invention) cause corrosion, and that ion-exchange resins could replace heteropolyacids as catalysts (again not a feature of the present invention).

Nishino relates to the preparation of ethyl acetate by the reaction of ethylene and acetic acid over a heteropolyacid catalyst. However, Nishino appears to say nothing about the desirability of removing metal impurities from the starting materials (feedstock) nor, indeed, is anything mentioned about metal

contaminents or impurities. Accordingly, Nishino adds nothing of relevance to the question of obviousness.

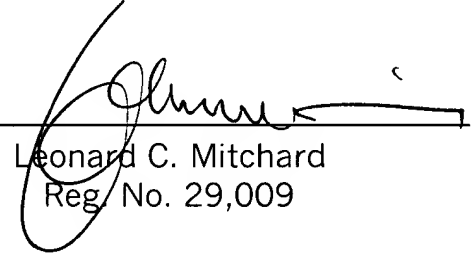
In light of the above, there would have been no motivation for one of ordinary skill to arrive at the present invention based on the cited art, either when taken singly or in combination. Absent any such motivation, it is clear that no *prima facie* case of obviousness has been made out. Withdrawal of the obviousness rejection is accordingly respectfully requested.

Allowance of the application is awaited.

Respectfully submitted,

**NIXON & VANDERHYE P.C.**

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**VERSION WITH MARKINGS SHOWING CHANGES MADE**

**IN THE CLAIMS**

1. (Twice amended) A process for the production of lower aliphatic esters which comprises reacting a lower olefin with a saturated tower aliphatic mono-carboxylic acid in the vapour phase in the presence of a heteropolyacid catalyst, wherein a) the reaction is carried out in a plurality of reactors set up in series, and b) the feedstock [is rendered substantially free] has no more than 0.1 ppm of metallic or metal compound impurities prior to being brought into contact with the heteropolyacid catalyst.